

Water Situation at Fukushima

(As of September 20, 2013)

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What is the current issue?

Over the past three months, radiation measured within the plant site in the water near the unit 2 trench at the site has been increasing. The increase in radiation in the water is caused by contaminated water traveling underground to the sea. Sources of the contaminated water include: 1) a trench near the bay (the radioactive water has since been removed (8/30)), and 2) water contaminated by the accident and continued cooling of the damaged cores leaking directly from the reactor buildings. In addition, at least one of the tanks storing highly contaminated water is leaking—that leak has been rated a three on the International Nuclear Event Scale. The Japanese government will be providing financial and technical assistance to TEPCO, the utility.

What are the health effects?

Available evidence leads the NRC to conclude the Fukushima situation will not affect U.S. public health. For the last six months, radioactive Cesium levels where the Fukushima harbor meets the ocean have been below 10 Bq/L, which is the World Health Organization drinking water standard. The U.S. Environmental Protection Agency's (EPA) limit is 7.41 Bq/L. Seawater sampling at points 30 to 200 km out to sea from Fukushima shows very low Cesium 137 concentrations; typically below .004 Bq/L, compared to pre-accident concentrations of around 0.003 Bq/L. Concentrations nearer to the coast tend to be somewhat higher (about .01-0.2 Bq/L), but still well below EPA drinking water standards.

To date, there is no evidence that radionuclides from the Fukushima incident are present in the U.S. food supply at levels that would pose a public health concern. The Food and Drug Administration (FDA) monitors the safety of FDA-regulated food, including seafood. For information about FDA efforts to ensure the safety of the U.S. food supply, please see:

<http://www.fda.gov/newsevents/publichealthfocus/ucm247403.htm>

How did the leaks occur?

Understanding how water is managed at Fukushima helps explain how these leaks are occurring. There are several factors contributing to the water situation. These include:

- Circulating water to cool the reactors
- Ground water flow into and leaking out of the basements of the reactor and turbine buildings
- Accident water left in trenches
- Leaking storage tanks containing highly contaminated water

Circulating water to cool the reactors

TEPCO pumps approximately 800 tons/day of highly contaminated waste water out of the reactor building/turbine building basements. This water is desalinated and then filtered to remove radioactive cesium. About 400 tons/day is pumped back to cool the reactors, becoming contaminated again as it flows through reactor core debris, before flowing back to the reactor building/turbine building basements. The rest of the water, 400 tons/day, containing high concentrations of Strontium-90 and tritium, is pumped to the ever growing storage tank farm.

Ground water flow into and out of the basements of the reactor and turbine buildings

The structures of the reactor and turbine buildings were damaged in the earthquake and the subsequent nuclear event. Therefore, groundwater is able to enter the basements of those buildings. TEPCO intentionally keeps the level of the water in the basements (the water pumped in to cool the reactors plus the water leaking in) lower than the water table on the outside of the basements so that it is easier for the groundwater to flow in than for the contaminated water to flow out. The groundwater that enters into the basement accounts for the approximately 400 tons/day more water that TEPCO pumps out of the basements than it pumps in in order to cool the reactors. Once the groundwater is in the basement, it mixes with the now-contaminated cooling water.

Some of the contaminated water leaks out of the basements into the soil and the groundwater, despite the outside water table being higher. This contaminated water includes radioactive cesium, strontium, and tritium. Cesium moves very slowly in groundwater, since the soil adsorbs (holds on its surface) the Cesium. Strontium is adsorbed less than cesium and moves faster, while tritium remains with the groundwater as it flows toward the harbor. As will be discussed below, TEPCO has plans to impede the flow of groundwater.

Accident water left in trenches

A second source of ocean contamination may be the trenches, U shaped concrete tunnels where pipes and electrical cables run between the sea water pumps and the turbine buildings. These trenches flooded during the accident on March 11, 2011. The Unit One trench was flooded with tsunami water and contains very little radioactivity. The Unit Two trench was flooded with highly contaminated accident water. Until the recent increase in the radioactivity measured in the harbor near the trench, TEPCO had believed the water in the unit 2 trench was contained. On Aug. 30, 2013, TEPCO pumped the water from the unit 2 trench to the turbine building basement and will continue monitoring to determine if this arrests the increasing release of radioactive materials to the Fukushima harbor.

Leaking storage tanks containing highly contaminated water

The storage tanks holding the excess, contaminated water pumped out of the reactor building are also a concern. One of those tanks, Tank No. 5, leaked roughly 300 tons of highly contaminated water through an open berm drain valve to the surrounding soil. TEPCO is digging up soil to determine the extent of water migration and inspecting other tanks to determine if there are other leaks. The Japanese Nuclear Regulatory Authority (JNRA) declared this event a level 3, serious incident, on the International Nuclear and Radiological Event Scale based on the amount of radioactive material released from the storage tank. The Japan Nuclear Regulatory Authority released a public report on September 5, 2013, in which they describe the current situation of contaminated water leakage and possible issues with the storage tanks. The report may be found here: <http://www.nsr.go.jp/english/index.html#Highlights>. The tank farm's radioactive strontium levels represent a very significant potential contamination source, so Japanese officials are developing a system to remove the strontium from the stored water.



No. 5 Tank



Berm

What is being done to address the situation?

TEPCO and the government of Japan are taking several actions to address the issues. The utility is trying to limit the flow of water to the ocean. They have pumped the highly contaminated water out of the potentially leaking trench. They are inspecting the other storage tanks to determine if there are any other leaks. They also have plans to remove the radioactivity from the stored water, but the system is not yet operational.

To limit the flow of water to the ocean, they are completing a steel wall at the edge of the harbor to block ground water. They are also injecting sodium silicate (liquid glass) into the soil to form an additional groundwater-blocking wall. Water trapped behind these walls will be pumped out and treated to limit the amount of radioactive contamination reaching the ocean. TEPCO plans to start operation of a ground water bypass system to pump up ground water before it reaches the reactor buildings/turbine buildings and pump it directly to the ocean. TEPCO plans to restart a sub drain system to pump and treat ground water from directly below the turbine buildings. There are also plans to construct, with Japanese Government support, a subterranean frozen soil wall around Units 1 through 4 to prevent ground water from mixing with highly contaminated water in the reactor building/turbine building basements.

An Advanced Liquid Processing System (ALPS) is being built that will remove all the radioactive elements except tritium from the highly contaminated water that is being stored in the tanks. This system will be able to process 750 tons of water per day and is currently expected to start operating in 2015.

What is the United States doing?

The NRC continues to regularly discuss the situation with JNRA (Japanese Nuclear Regulatory Authority) and TEPCO, and stands ready to support JNRA if asked. In addition, the NRC is communicating routinely with other federal and state agencies.

The Department of Energy has been providing assistance to the government of Japan since 2011. For more information on their activities, please see <http://energy.gov/em/articles/em-leads-successful-workshop-supporting-fukushima-cleanup>.

The Food and Drug Administration (FDA) monitors the safety of FDA-regulated food, including seafood. For more information, please see: <http://www.fda.gov/newsevents/publichealthfocus/ucm247403.htm>.

NOAA (National Oceanic and Atmospheric Administration) is responsible for modeling and monitoring the movement of marine debris related to the tsunami in Japan. The NOAA Marine Debris Program is working with federal, state, and local partners to collect data, assess the debris, and reduce possible impacts to our natural resources and coastal communities. For more information, please visit <http://marinedebris.noaa.gov/tsunamidebris/>.

The Environmental Protection Agency (EPA) continues to monitor the situation and interface with other federal agencies. For EPA's RadNet program, which monitors radioactivity levels in the environment, please see <http://www.epa.gov/radnet/>.

Where can I go to get more information?

In addition to the websites above, you may get information from the English-language versions of two Japanese government websites:

Japanese Nuclear Regulatory Authority-
<http://www.nsr.go.jp/english/>

Japan's Ministry of Economy, Trade, and Industry
<http://www.meti.go.jp/english/>